Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE
AMERICAN
MATHEMATICAL MONTHLY.

Entered at the Post-office at Springfield, Missouri, as second-class matter.

VOL. XV. FEBRUARY, 1908. NO. 2.

EXTERNAL ENCOURAGEMENT FOR THE STUDY OF HIGHER MATHEMATICS.

By DR. G. A. MILLER, University of Illinois.

Among the potent external encouragements for the study of higher mathematics are the international congresses, national societies, prizes, fellowships, and scholarships. In our own country the last two relate mainly to those who are beginners in original mathematical work while the others affect principally those who are continuing such work after the so-called student days. The first formal international mathematical congress was held in Zürich, Switzerland, in 1897, and it was then resolved to hold such congresses about every three years in various countries. Thus far only two others have been held,—one in Paris, France, in 1900, and the other in Heidelberg, Germany, in 1904. The fourth is to be held in Rome, Italy, in April of the present year. The interest in these meetings has been growing rapidly as is partly evidenced by the fact that the published reports contain 306, 450, and 755 pages, respectively.

The oldest mathematical society extant is the one at Hamburg, Germany, having been founded in 1690, and hence it has continued in activity over two hundred years. It can scarcely be called a national organization, especially since the founding of the Deutsche Mathematiker-Vereinigung in 1890, which holds its annual meetings in various parts of the German Empire in connection with the Gesellschaft Deutscher Naturforcher und Arzte. This has become the largest and one of the most influential mathematical societies of the world, even if its fees are only nominal,—2 marks per annum, or 30 marks for life membership. A considerable portion of its 700 members is composed of foreigners so that it, like the other leading societies, is partly international. It publishes a journal, which now appears monthly, and is perhaps best known on account of the extensive reports on the present state of various branches of higher mathematics, which have appeared in it from time to time. Members may receive this journal and occasional other publications at a reduced price.

The London Mathematical Society is the oldest among the prominent extant societies, having been organized in 1865. It publishes a journal known as the *Proceedings of the London Mathematical Society* which is sent to all the members free of charge. The annual dues are 21 shillings, and there are about 300 members. Next in point of age among the leading societies is the Mathematical Society of France, which was founded in 1872, and had Chasles for its first president. It has published a journal known as the Bulletin since its organization and has always had the leading mathematicians of France among its members even if its growth has been less rapid than that of other prominent societies. Its annual dues are fifteen francs, and its members receive the Bulletin free of extra charge.

Whatever differences of opinion may exist in regard to the relative excellence of the mathematical productivity of various countries, all agree that the countries which use the four languages, French, German, English, and Italian, are pre-eminent and have been pre-eminent for centuries. Hence the student of mathematics who desires to keep well informed in regard to important advances in various lines of mathematical activity must be able to read mathematical works in these four languages. The most active Italian mathematical society of the present is the Circolo Matematico di Palermo which was founded in 1884 and has a membership of 500, among whom are eighty Americans. It is of interest to note that the Americans constitute the largest foreign element in this society, the Germans coming next with fifty-four members. It publishes a journal known as the Rendiconti which is mailed to all its members, the annual dues being the same as those of the French society.

The American Mathematical Society is one of the youngest among the great mathematical societies of the world, having been founded under the name of the New York Mathematical Society in 1888 and hence being only two years older than its German brother. Its growth in numbers has been almost as rapid as that of the German society notwithstanding the fact that its annual dues are ten times as large, being 5 dollars per annum. In view of these larger dues it has been able to render more substantial support to important outside projects, the most noteworthy of these being the publication of the Transactions of the Society in addition to its Bulletin, the latter being sent to all its members free of charge. Both of these journals have maintained a very high standard and have contributed materially towards winning for Americans a favorable recognition among the leading mathematicians of the world. They have also furnished avenues and standards of publication for the younger mathematicians and thus contributed largely to the rapid mathematical development in this country during recent years.

A peculiar feature of the American Mathematical Society is the organization of sections in different parts of our extensive country. Thus far three such sections have been formed — the first at Chicago in 1897, the second at San Francisco in 1902, and the third in the Southwest, starting at Columbia, Mo., in 1906. Each of the first two sections meets twice a year at or near its place of organization, while the third has had only one meeting a year thus far. These sectional meetings afford opportunities for the members who are located far away from the regular places of meeting of the society, to get together to consider such questions as may tend towards definite advances or to renew courage to proceed in a struggle which must frequently be conducted under adverse circumstances. These meetings and the publications mentioned above are perhaps the most important lines of activity by means of which the American Mathematical Society has centralized and improved the efficiency of mathematical endeavor in our country, but many related minor influences could be mentioned.

Although prizes have not contributed as much to American mathematical progress as to that of Europe, yet the international prizes offered by European institutions have doubtless done considerable to stimulate work of high order in this country especially since a few of them have come to American mathematicians. The Institute de France is perhaps the best known among the prize bestowing institutions, both on account of its long history and also on account of the eminence of many of its members. Hence scholars appreciate these prizes much more than their money value would imply, being frequently less than five hundred dollars. It is of interest to note that one of the most valued mathematical prizes of the French Institute was awarded to a woman, Sophie de Kowalevski, in the year of the founding of the American Mathematical Society, for the discovery of a new case in which it is possible to integrate the differential equations of the movements of a heavy body having a fixed point.

In most cases these prizes are offered for the solution of a definite problem or for work which tends towards such a solution but in some cases they are given for published work of unusual merit. In 1858 the Grand Prix de Mathématique was offered for the proof of a theorem announced by Legendre in his *Théorie des nombres*, which was afterwards proved to be incorrect, as had been suspected by those who proposed the prize. It may be of interest, in this connection, to mention a very unusual astronomical prize of 100,000 francs which is being offered annually to any one who will establish communication between the Earth and some other star than the planet Mars. It appears that the widow who founded this prize considered communication between Mars and the Earth as too easy to be a subject of this magnificent prize. By a wise provision the interest of this fund may be spent every five years to encourage astronomical research as long as the desired communication is not established.

Fellowships and scholarships have probably constituted the most potent external factor in promoting mathematical research in our country, as they have enabled many young men to get a good start in their scientific careers. It is a sad fact that most of them have accomplished very little beyond the start but the few who continued their work with great energy have more than justified this method of promoting scientific activity.

As fellowships and scholarships are generally reserved for those who have given evidence of unusual ability and have attained at least the equivalent of the bachelor's degree at a good institution, they render assistance just when original work can be begun with sufficient promise of success to become fascinating and inspiring.

The first American university to establish graduate fellowships on an extensive scale was Johns Hopkins, which provided for twenty such fellowships, each yielding $500, at the opening of the institution in 1876. Some of the universities which were opened later, especially Clark and Chicago, adopted similar plans and thus exercised a strong influence to raise the standard of scholarship to a much higher plane. Many of the older institutions and friends of these institutions have succeeded in establishing equally favorable conditions, which have enabled many young men to get into the research spirit and to learn how to secure new answers from nature, which is rich but not always liberal. In 1894, G. Stanley Hall published in *The Forum* a list of graduate scholarships and fellowships at all the American institutions. There were then only eight universities having more than ten such positions. Since that time conditions have greatly improved. At the University of Illinois, for example, the amount available for such appointments is now more than ten times as large as it was then.

There is a great difference in the demands which the various institutions make upon their graduate scholars or fellows. In some cases the only condition is that the holders of such positions shall reside at the institution and devote all their time to study. In the case of travelling fellowships the incumbent is generally expected to spend his time at one or more of the best institutions in the world along the lines in which he may be especially interested. These scientifically ideal conditions constitute one extreme, the other extreme being presented by the institutions which use these positions to secure a large amount of service, teaching, or reading of papers, at a remarkably low cost and allow the incumbent so little spare time for study as to dwarf him intellectually. The money value of these positions is generally small, varying from free tuition to 700 dollars per year, while a very few specially endowed fellowships pay much more.

For instance, the Kellogg fellowship of Amherst College provides the income of thirty thousand dollars and is awarded for seven years to an alumnus of this college, who shall be selected by the faculty. The first three of the term of seven years shall be spent in study, generally at some foreign institution, and the last four as a lecturer at Amhert College, but the incumbent shall not give more than thirty lectures per annum and shall have no employment except such as pertains to the duty of his fellowship. This fellowship is open to students of mathematics as well as to those interested in other lines, and evidently aims to train the incumbent for a highly scholarly life. It is to be hoped that more positions of this kind will be established, especially in connection with the larger institutions, in order to maintain high ideals among the large student bodies.